N2 Adsorption and Desorption (Brunauer-Emmett-Teller, BET)

Motivation

- What can be determined?
  Surface area; pore volume; pore size distribution; active sites
- Where it can be used?
  - Petroleum and mining industry; pharmacy; agrochemistry; environmental application etc.

Experimental setup

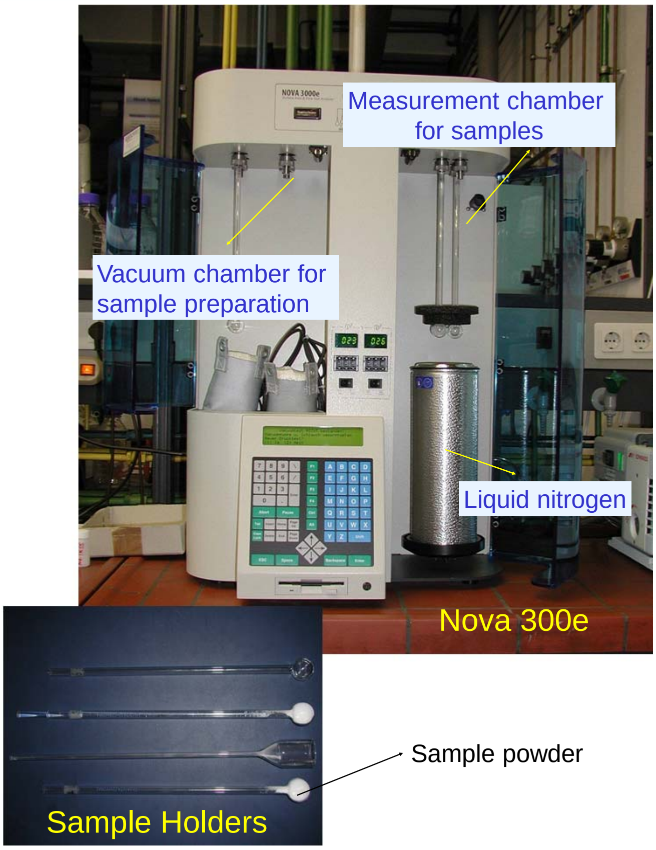

Figure1. Equipment for N_2 adsorption/desorption experiments.

Data Analysis

- Based on adsorption/desorption isotherms
- BET equation solved regarding the monolayer capacity W_m:

$$\frac{1}{W((P_0/P)-1)} = \frac{1}{W_m C} + \frac{C-1}{W_m C}\left(\frac{P}{P_0}\right) \qquad S = \frac{N_A W_m \sigma}{M};$$

where W_m is the mass of gas adsorbed as monolayer at a relative pressure P/P_0; P_0 is the saturated vapour pressure; C is the BET constant; N_A = is the Avagadro number; M is the molecular weight of adsorbate, σ is the cross sectional area of adsorbate, S is the total surface area.

- Pore volume filling method is used to measured the total volume of the pores (at $P/P_0 = 0.99$).
- Pore size distribution is measured by BJH (Barret-Joyner-Halenda) desorption isotherm

Example

N_2 Adsorption and Desorption isotherms

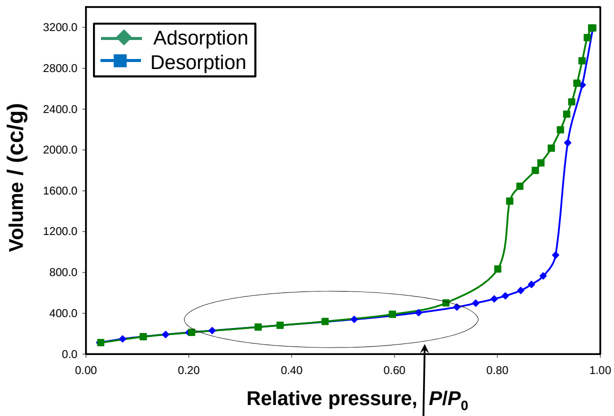

Figure 2. Typical adsorption isotherm of mesoporous materials

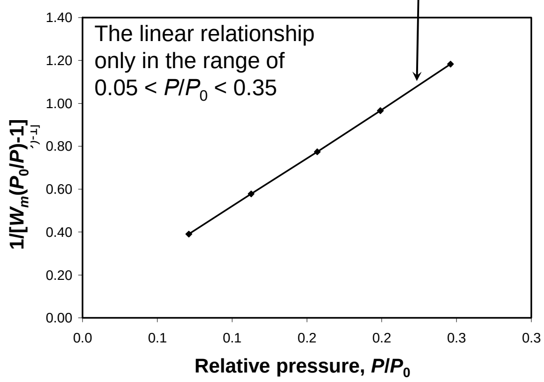

Figure 3. BET analysis of adsorption isotherm

- From the slope and intercept, W_m and C as well as the surface area (S) are calculated

Pore size distribution curves

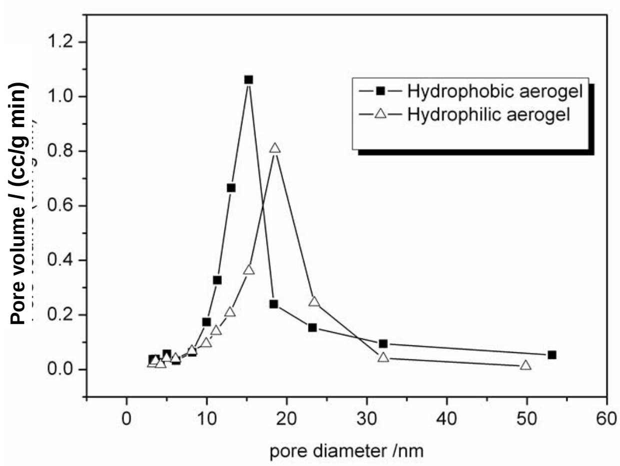

Figure 4. Typical pore size distribution of mesoporous substances (aerogels) from BJH desorption analysis.

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